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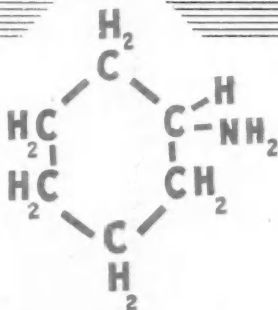
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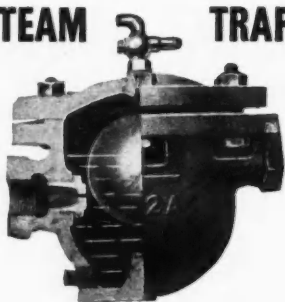
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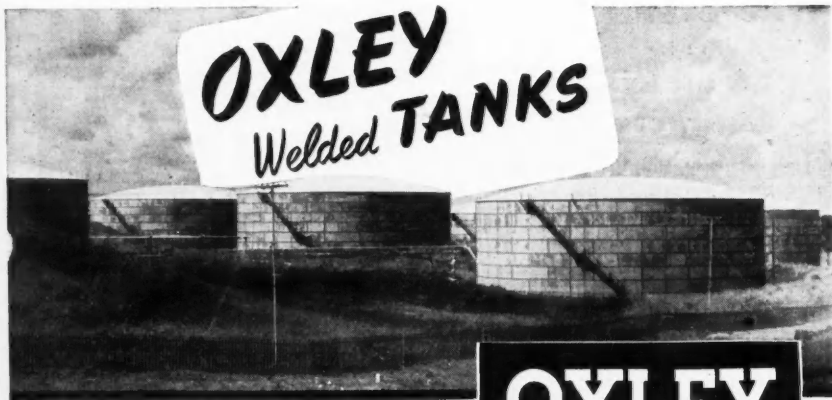
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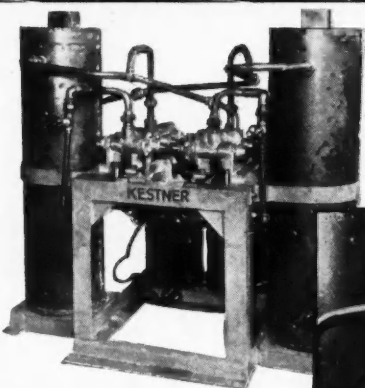
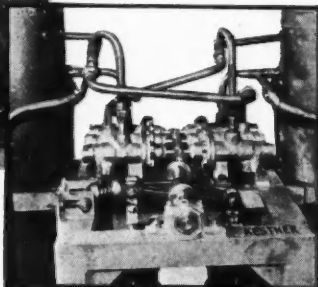


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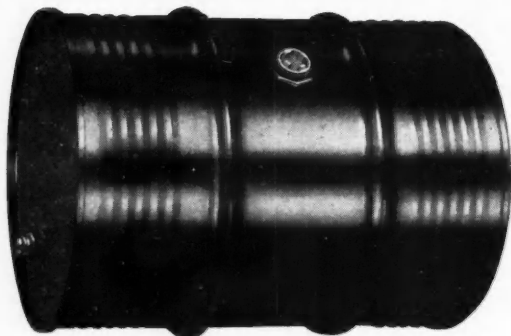
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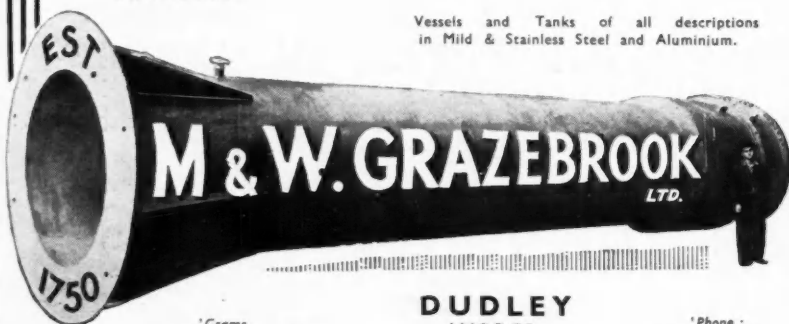
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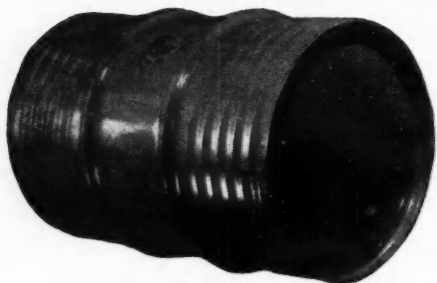
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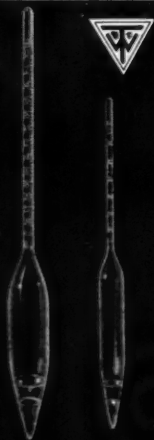
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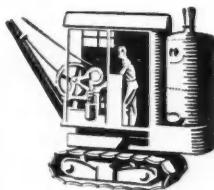
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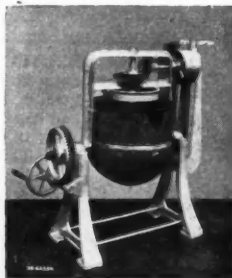
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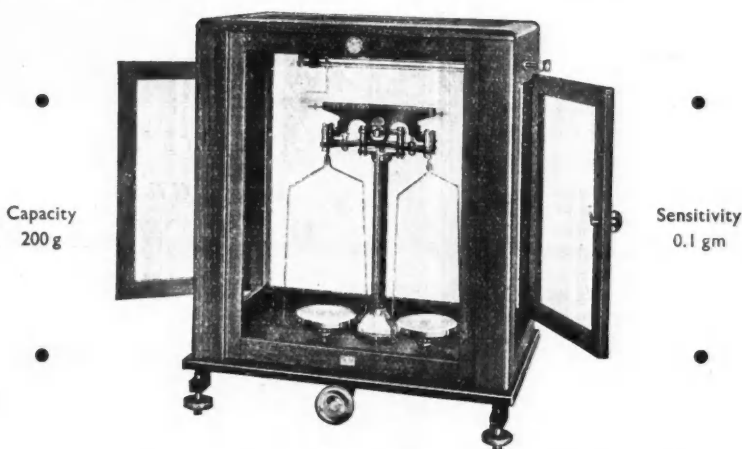
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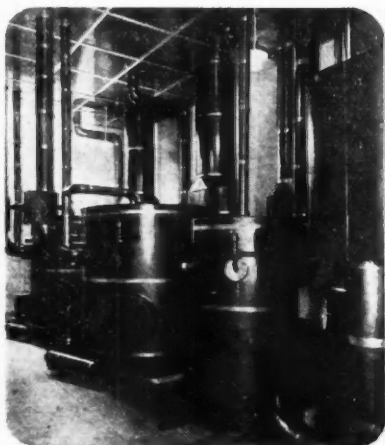
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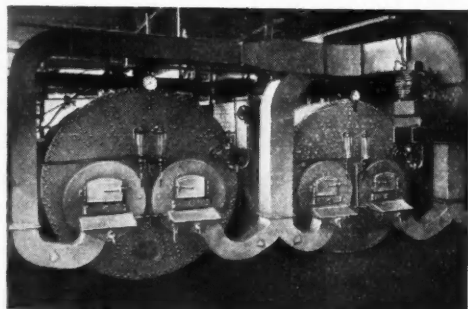


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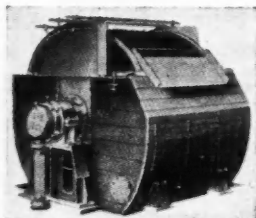
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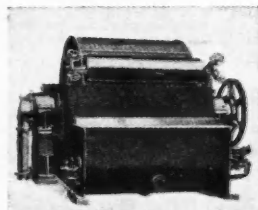
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No. 1376.

November 10, 1945

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The Tar Distillation Industry

THE quantity of coal tar produced in this country is not great in comparison with the output of other major industries. Its tonnage cannot compare with that of steel, or of coal, or of coke, nor can its value compare with that of textiles, of wool, of leather, or of engineering products. The production of coal tar is not a major industry in itself; it is derived as a by-product from coal carbonisation. Nevertheless, tar distillation is a key industry. It provides many substances which we cannot equally well procure from other sources and which cannot be manufactured synthetically at equally low cost. It is the principal source of raw materials for the organic chemical industry. The annual production of crude coal tar is of the order of 2 million tons, of which some 60 per cent. is derived from gasworks and 40 per cent. from coke ovens. There is also coming into being slowly, but possibly with accelerated speed since the war, a technique of low-temperature tar distillation and a supply of low-temperature tar on which this technique can be practised.

A comprehensive and authoritative account of the history and present practice of the tar distillation

industry was lately given by Mr. W. G. Adam as the second Stevens Memorial Lecture to the Junior Institution of Engineers. This paper is an invaluable record of the progress and set-up of an industry which has few textbooks (and we believe no modern textbook) and which is not often the subject of technical papers, except in its relation to road engineering. The picture which Mr. Adam paints is one of a live industry developed from small beginnings over more than a century of progress and employing modern processes to attain its objectives. Mr. Adam deprecates criticisms that have been made in regard to the tar industry and in more than one place in his paper he endeavours to correct what he considers to be misconceptions as to the

technical state and business organisation of the industry. We have in these columns criticised the tar industry on more than one occasion, and we still maintain that, good as has been the achievement in the last 10 or 15 years, there is a great deal yet to accomplish before the coal tar industry can be satisfied with its progress. The plant with which Mr. Adam is connected is well known as an outstanding example of modern

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distillation practice, but there are tar works up and down the country in which a great deal of modernisation is required. Mr. Adam maintains that "contrary to general belief, the tar industry has little to learn of the science of fractionation." Again, we would agree that that is true of some works; it is not true of all the works. It may be that the knowledge is there, but that practice lags behind knowledge.

A criticism which we have made from time to time is that coal-tar products are too valuable to be burnt as fuel and that the fact that they are burnt is a confession of failure—failure to find a proper use for them. Mr. Adam's defence of this practice is on the following lines:—

"To the layman," he says, "this would appear to be a wasteful policy, but markets simply do not exist for the many substances known to be present in creosote and pitch. Many years may elapse before developments of sufficient magnitude occur in this field, and meanwhile the tar distiller must live and suffer the many loose statements which are made without a true appreciation of the facts. So often the tar distiller is asked to supply semi-commercial quantities of a special product not previously isolated, and, after he has gone to a great deal of trouble and expense to effect the necessary separation, he finds that the demand is soon satisfied and thereafter will only be spasmodic if it exists at all. On the financial side these ventures are rarely profitable, but they are often in the national interest, and the experience gained may be valuable; but it cannot be too strongly emphasised that only large-scale developments foreshadowing continuing markets will effect a 'general' change in tar distillation practice and marketing policy. Many valuable therapeutic, photographic, and other chemicals are being prepared from coal-tar products, but with the best intentions it is difficult to imagine developments on such a scale in these fields. The brilliance and social value of some of these discoveries tend to blind one to their relative insignificance when viewed from the angle of tonnage required and possible revenue. In the past, the more progressive tar distillers have carried out or taken part in a great deal of research and development to fit their products for various purposes and to ensure their utilisation in the best possible manner. In addition to the work carried out by members, and the co-operative research sponsored by the British Road Tar Association and the National Benzole Association, the Association of Tar Distillers is planning

centralised co-operative research on a national basis to cover the remaining field. With strong practical support by the user interests, this may lead to developments which the tar industry would welcome, with the possibility of changes in tar distillation practice and technique."

Mr. Adam's defence is certainly justified in many respects, but it neglects altogether the fact that far too little research has so far been conducted. Only now is the Association of Tar Distillers "planning centralised co-operative research on a national basis." Recently we discussed Dr. Clibbens's account of the development of textile chemistry in which he pointed out that, during the empirical period of research, progress was slow and that only recently has the way been opened to more rapid progress on the basis of sound scientific development. From a slightly different angle the same is true of the tar distillation industry. Mr. Adam's account of the development of the industry shows how much it owed to chance discoveries by those who were not engaged in coal tar distillation. Mackintosh and the water-proofing of textiles was an early development of this nature. The recovery and use of benzene is another. The development of dyes from coal tar is yet another. So also is the use of tar in road making. Finally, the greatest potential chemical field of all, that of plastics, has been developed entirely from outside the industry. Is it not true, therefore, that in the past tar distillation has waited for someone else to find a use for its products and has then set about making the products available if the demand appeared to be sufficiently large?

We have long maintained that if the coal-tar industry had engaged in anything like the volume of research (proportionately to its size) as has the petroleum industry, the British organic chemical industry would be in a very much better state than it is to-day. If markets do not exist for the many substances known to be present in creosote and pitch, that is the opportunity for a research association.

If we appear to be singling out the coal-tar industry for these strictures it is because we recognise that coal tar is a treasure-house of organic materials to which there is no counterpart in this

country and that by enough intensive research and with a sufficiently skilled personnel the way may be open to a considerable increase in the national wealth. Mr. Adam left his audience in no doubt about the importance of coal-tar distillation in the wealth of products it supplies to many other industries. We are convinced that coal tar has an

even greater part to play in the future, and it is our firm belief that when the reconstruction of the coal and carbonising industries is complete, a very large increase in the output of coal tar will be demanded. We urge that the plans for centralised research be put into early effect on a bold and comprehensive scale.

NOTES AND COMMENTS

Argument on Steel

AN argument is going on, in the columns of *The Times*, concerning the extent to which the German heavy industries should be allowed to rehabilitate themselves. Mr. Lincoln Evans, assistant general secretary of the Iron and Steel Trades Federation sounds a warning against allowing "an over-industrialised and over-stocked German industry to become a menace again for the peace-loving nations," and states that he cannot see the necessity for allowing Germany to have larger industrial resources than are sufficient to satisfy her home needs, plus a moderate excess to provide for a limited amount of exports for some years, to be used for the payment of reparations. The editorial attitude taken up by *The Times*, however, is that such a policy would be counter to the plain facts of European economy; the dangers of rigid controls are indicated, and the moment is envisaged when the United Nations will lack "either the unity or the firmness of purpose to maintain the controls in being," while the usual argument is brought forward about "the close economic interdependence of all the main industrial areas of the European continent."

Another Fairy-Tale

OUR view is that Mr. Evans makes his best point when he remarks how Germany, as after the last war, is beginning to have first claim on our attention. If we are going to consider the rehabilitation of European industry, what about the claims of the Dutch, Belgian, Polish, Norwegian, and French industries? *The Times* is right to demand the utilisation of the whole available industrial power of Europe for healing the wounds of war. In fact,

the German industrial potential is much farther from being destroyed than judicious propaganda would make out. As Mr. Evans says, European recovery may take longer without the rehabilitation of Germany, but if it actually depends on such rehabilitation (which we do not for a moment believe) we might well ask whether it is worth while recovering. The legend of the pre-eminence of German chemistry and chemical industry has been once and for all exploded; we suspect that the indispensability of German heavy industries is just such another fairy-tale.

Business Shows the Way

AT a moment when the Bank of England has been "nationalised" and when certain great industries are on the road to complete State control, a most timely speech has been made by a prominent British industrialist. We refer to the speech of the chairman of Lever Brothers and Unilever, Ltd., at their annual meeting. Mr. Geoffrey Heyworth made little direct reference to politics, and the purely business character of the address gave added weight to his survey of a great modern enterprise at work under progressive management. Mr. Heyworth began by reminding the shareholders that the main purpose of an annual meeting is to enable them to vote "for or against the continuation in office of the board of directors." In other words, the government of industry is already subject to the democratic principle, always provided (as in national affairs) that those entitled to vote exercise their responsibility. In order that shareholders may have the necessary information on which to base their views, the Unilever Board will in future issue a review in advance of the meeting, in a form which may

well become a model for British industry as a whole. It reveals a breadth of vision and a sense of values which are encouraging in these days when so many aspects of private enterprise are subject to ill-informed criticism.

A New Type of Report

REFERRING first to trading operations, usually presented in terms of finance, Unilever consider that mere sales figures will not be appropriate. "We never think of our operations in that way ourselves; we think of tons of raw materials, cases or tons of soap, pounds or tons of margarine and so on." As for trading results, which are really historical records, it is felt to be neither wise for the shareholder nor fair to the Board to form a judgment wholly on these records. "Decisions are made on the basis of estimates, projections, surveys and guesses. The lapse of time between the decision and its fruition in the form of profit or loss varies from a term of years to hours, and during all this time the factors that determined the decisions are changing." It is useful to be reminded of the element of risk that enters into the operations even of the largest businesses, since all too many people now assume that trade—particularly in staple commodities like soap—is a more or less automatic process calling for the minimum of skill in its direction.

The Road to Co-operation

ON the subject of the management of staff, Mr. Heyworth said that the Board seeks to make every member of the organisation "feel a part and not an appendage of the whole" and aims at ensuring promotion on merit. This aspect of the Unilever activities is facilitated by the international character of the business. Many of their executives have worked in more than one country, providing "a most effective means of breaking down prejudices and begetting a willingness to adopt new approaches to old problems." The fact that manufacture and research are carried on in many countries contributes to the progress of them all; "so much so that it is difficult to say how much of our experience is derived from home sources and how much from abroad." Business thus shows the way to achieve

co-operation between peoples and countries in the service of a common purpose. There is a pressing need for this example to be followed if British industry is to resume the world-wide leadership which marked earlier eras of expansion. Not only will trade benefit, but effective foundations will be laid for a lasting peace.

Geologists Look Ahead

FORETHOUGHT is not an especially noticeable virtue among the British, and because of the lack of it we suffered more during the late war than perhaps absolutely necessary. Now and again, however, we do come across instances of how certain persons made provision against a rainy day. The work of the Geological Survey of Great Britain is to be recorded as an example of intelligent forethought, and a detailed exposition, by Dr. W. D. Evans, of what the Survey did in aid of the war effort (both before and during hostilities) is published in the October *Discovery*. Chemists and metallurgists owe much to the efforts of their geological confrères. It has long been known, for example, that there are extensive occurrences of non-ferrous metals in Britain; but it was thanks to the Survey that months of fruitless searching among old tin and wolfram mines in Cornwall were avoided—they had already determined which of the veins were worth working. Similarly, fruitful extensions among the lead, zinc, barytes, and fluorspar deposits of the North Pennine area were made possible by their aid; and sources of felspar—up to now practically unworked in Britain—and of mica located and worked. Geological research has found a method of distinguishing the parts of the Midland ironstone ore-bed which are richest in iron; and, more important still, war-time investigations there will lead to the development of larger pits unhampered by problems of drainage and land-restoration. Novel methods of boring and new flotation processes have also been developed, and finally—to touch on a subject which demands a complete article to itself—if it had not been for the systematic work on hydrogeology carried out before the war, this country would have been faced with many serious situations involving its war-time water supply.

Important New Dielectrics

High Permittivity of Barium Titanate

by G. STANLEY SMITH, B.Sc., A.R.I.C.

THE discovery, recently reported in Russia, of substances possessing very high permittivities appears likely to be of considerable practical importance in the field of dielectrics. One substance in particular—barium titanate—has a permittivity much above 1000, which implies, for instance, that if this material is used as the dielectric in a condenser the electrical energy which may be stored in the condenser will be more than a thousand times that possible in a similar condenser, charged to the same voltage, but containing air as the dielectric.

The capacity, or capacitance, of an isolated conductor is defined as the charge required to raise its potential by one unit, i.e., $C = q/V$. The presence of another charge in the neighbourhood alters the potential of the first and may cause it to drop. This is the case when the second charge is one which has been induced by the first and the decrease must obviously produce an increase in the capacitance if the charge remains unaltered. Such a system forms a condenser. The value of the capacitance may be calculated from the dimensions alone, and it may be expressed in units of length. In this it is assumed that the nature of the medium between the plates or other conductor parts of the condenser need not be considered. Actually, however, the medium has a great effect. It must, of course, be an insulator, but there comes into play here a property of the material which has to be distinguished from its non-conductivity, that is, its dielectric capacity.

Capacitance Values

When capacitances of condensers containing different media but otherwise alike are compared it is found that a condenser containing air gives practically the same value as that with a vacuum between the plates and that all the other condensers give higher values ranging up to 81 times (in the case of pure water) that of the capacitance of the vacuum or air condenser if the observations are restricted to common substances. These values, expressed on a scale with unity as the figure for a vacuum, are independent of the shape or dimensions of the condenser, and are constants for the various materials. The property so measured was formerly known as the specific inductive capacity or the dielectric constant, but the term permittivity is now commonly used. The formula for the capacitance of a condenser should, therefore, be written, $C =$

Kq/V , where K is the permittivity of the medium. The constant appears also in the expression for Coulomb's law. Thus, in a medium of permittivity K , the force between two charges q and q' , separated by a distance r , is qq'/Kr^2 .

The permittivity of a substance is a question of the displacement of the electrical charges in the material under the action of an external electric field. The polarisation, as it is called, is normally a combination of two or three distinguishable types of polarisation. One type is due to the fact that all substances are made up of atoms each containing positively and negatively charged parts which tend to be displaced from their positions of equilibrium by the action of an electric field so that the centre of gravity of the positive charge no longer corresponds with that of the negative charges. As a result we have the type of polarisation known as electronic. Each atom obtains an "induced dipole moment."

Permanent Dipole Moment

In general, however, we are not dealing with isolated atoms or even with compounds of atoms of the same kind but with substances in which unlike atoms are combined to form molecules. In the latter case, the centres of gravity of the positive and negative charges may be displaced by the effect of combination alone and the molecule is polarised already before it encounters an external electric field—it has a "permanent dipole moment." In an electric field the polar molecules tend to orientate their axes in the direction of the field, and a displacement of the atoms in each molecule takes place. There is present, therefore, a polarisation through orientation of the dipoles and a polarisation due to the displacement of the ions of opposite signs—ionic polarisation—in addition to the electronic polarisation. These all represent displacements of electric charges from a natural position of equilibrium, and the material in which they occur must in consequence possess an extra amount of energy due to its presence in the electric field. Under similar conditions the density of energy of an electric field in a substance is clearly greater than that in a vacuum. The permittivity is a measure of this effect.

Most substances normally used as insulators possess fairly low permittivities—about 2.5 for ebonite and transformer oil, and about 6.7 for mica, glass, and porcelain—but values of the order of 100 were obtained a few years ago in a study of the dielectric

properties of rutile (titanium dioxide) and ceramics based upon rutile. In Russia work on the permittivities of such compounds has been actively pursued ever since 1930 when Ioffe pointed out the practical possibilities of their application as dielectric. Vul, who was closely associated with Ioffe in the early stages of the work¹ and subsequently carried out a number of investigations with other workers at the Institute of General and Inorganic Chemistry, has recently given an account² of some fresh discoveries which appear to represent the most fruitful part of the work so far. These are concerned with the titanates of the metals of the second group of the periodic table—beryllium, calcium, strontium, barium, magnesium, zinc, and cadmium—which were obtained by heating mixtures of the powdered metallic oxides with titanium dioxide under pressure to about 1500°C. The permittivities of the compounds so formed are given in the accompanying table.

Metal forming titanate	Permittivity	Lattice type	Radius of metal ion ¹ (10 ⁻⁸ cm.)	Ionic polarisation ² (10 ⁻²⁴ cm. ³)
Beryllium	70	not established	0.34	0.008
Calcium	115	perovskite	1.06	0.47
Strontium	155	do.	1.27	0.86
Barium	1200-3200	do.	1.43	1.56
Magnesium	17	ilmenite	0.78	0.09
Zinc	30	not established	0.83	0.28
Cadmium	62	ilmenite	1.03	1.08

¹ According to Goldschmidt.

² According to Pauling.

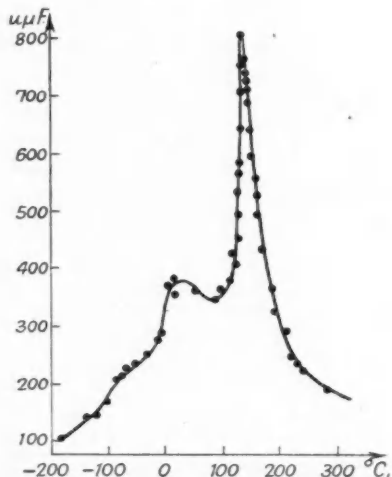


Fig. 1. Variation of capacity of barium titanate condenser with temperature.

This table indicates the crystallographic type (wherever possible), the size of the metal ion, and the value of the ionic polarisation for the purpose of understanding the permittivity figures. It appears that the titanates may be divided into two groups of different permittivity ranges and of different crystallographic type—the perovskite type and the ilmenite type (the minerals perovskite and ilmenite are titanates of calcium and of ferrous iron respectively). In each group the permittivity increases with the ionic polarisation, but it must be supposed that the bonds between the ions of different signs in the perovskite crystallographic lattice are weaker than those in the ilmenite lattice.

The unit of the perovskite lattice is a cube with an alkaline earth ion at the centre, with titanium at the corners and oxygen at the middle of each edge. As one passes from beryllium to barium in this group the radius of the ion increases, the edge of the

elementary cube gets longer, the distance between the ions becomes greater and the bond between them becomes progressively weaker. This produces an increase of the ionic polarisation and, coupled with the fact that the electronic polarisation also rises, leads to high values for the dielectric permittivity which attains an extremely high figure in the case of barium titanate.

The lower of the two figures for the permittivity of barium titanate shown in the table refers to compounds which were found to be slightly porous. The high figure of 3200 was obtained when very great pressure was used in preparing the sample. This value is extraordinarily high even for the perovskite group. It may be explained by the fact that the crystal of barium titanate is the only one in this group which has the side of its elementary cube greater in length than the sum of the diameters of the ions of oxygen and titanium, which occupy positions thereon. Thus, the distance between the centres of the ions is greater than the sum of their radii. The open structure which the molecule possesses would appear to be the reason for the relatively great polarisation which occurs under the action of an external electric field.

To the same cause would have to be re-

ferred certain peculiarities which have been observed by Vul in connection with the effect of temperature upon the permittivity. These are indicated in Fig. 1, a graph showing the way in which the capacity of a condenser containing barium titanate varies with the temperature. One may suppose that researches which are now being made on other physical properties of this substance are likely to prove of great interest.

IOFFE and VUL, *Elektrichestvo*, 1931, No. 12 (in Russian).

B. M. VUL, *Herald of Academy of Science*, 1945, No. 4, 107 (in Russian).

New Antimalarial

Important British Discovery

A NEW compound for the treatment of malaria has been discovered by a team of British workers—I.C.I. chemists and biologists who have been researching into antimalarial specifics since 1942.

This is an event of the first importance in chemotherapy—for three reasons. First, the new drug—which until recently was known as 4888 and is now to be distributed in a form to be known as Paludrine—appears at a time when measures to counter malaria are of vital consequence. Secondly, it marks a revolutionary departure in antimalarial research, since it is a much simpler compound than any antimalarial hitherto known. Finally, it is more powerful and has a much wider influence on malaria than any known specific.

There are three requirements of the perfect antimalarial. First, it should act as a preventative against infection; i.e., it should be prophylactic in action. Second, it should control the symptoms of the patient actually suffering from malaria. Third, it should prevent relapses, one of the worst features of this dangerous disease. Quinine and mepacrine have proved most valuable for the second purpose, but only partly succeed in the first since they merely prevent, under the best circumstances, symptoms from developing. Frequently, a small number of parasites still remain alive in the infected patient, however, and it is common for such a patient to develop malaria some time after leaving the malaria-infested region. In addition, quinine and mepacrine have no value in preventing relapses of benign tertian malaria, one of the commonest forms of the disease.

In 1943, a team of I.C.I. research workers at Blackley, near Manchester, discovered the existence of antimalarial activity in a class of compounds hitherto unexplored for this purpose. This was a result of close collaboration in the same organisation between organic chemists and biologists, the only combination which could hope to achieve any worthwhile results with a problem of

this magnitude. The chemists were exploring new fields, and the biologists were testing their products with the aid of novel methods. They were not seeking to discover another quinine substitute, but to find an entirely new type of drug that would solve the hitherto unsolved problems of malaria therapy. The first essential was for the biologists to discover methods of testing to guide the attack on these problems. The successful achievement of this made all the rest possible. This work led to the discovery of Paludrine—a compound which marks a fresh turning point on the road to the conquest of malaria.

Medical Collaboration

These researches have been carried out in collaboration with the Medical Research Council. Paludrine was first administered to human patients early this year by the Liverpool School of Tropical Medicine, the wholehearted co-operation of which, from the outset, has given the utmost practical help and encouragement. After more than 100 cases had been successfully treated, supplies of the new drug, by arrangement with the Medical Research Council, were flown to Australia for most extensive clinical trials. Their results have confirmed that this new drug is not only more effective, but is also considerably less toxic than either mepacrine or quinine.

Paludrine is more effective than either mepacrine or quinine in its protective action against the infection from the bite of a mosquito, and it may be that suitable dosage will afford complete protection. Paludrine is considerably easier to manufacture than mepacrine or pamaquin. It is colourless, and does not produce the undesirable yellowing effect encountered in most cases treated with mepacrine. It is much more powerful in its action, one part of Paludrine being equivalent to at least 3 parts of mepacrine or 10 of quinine.

Among recently published trade literature is the second number in J. W. TOWERS & COMPANY'S valuable new series of booklets, entitled *Towers' Laboratory News*, issued from Victoria House, Widnes, Lancs. The introductory note gives some idea of the part played by the company in the war effort. It goes on to describe various scientific appliances manufactured by the company, among which is the convenient "Longlife" Condenser. This has the advantage of being readily taken apart for cleaning, and of having all its parts interchangeable. An apparatus of interest to the organic chemist is the Towers Micro-Molecular Still, which is made throughout of heat-resistant glass and it fitted with standard joints. The value of laboratory tubing made from polyvinyl chloride (PVC) is also stressed.

Calcium Production in U.S.A.

The Ferro-silicon Process

PRODUCTION of high-purity calcium metal by thermal reduction of calcium oxide under vacuum is one of the interesting war-time developments in metallurgical processes. While the basic principles involved have been known for many years, practical commercial operation was first developed at the Defense Plant Corporation's magnesium unit located in Canaan, Conn., operated by the New England Lime Co., according to an article by Mr. P. H. Straub in the August issue of *Chemical and Metallurgical Engineering*. The location was chosen because of the existence of dolomite deposits of high purity and low alkali metal content.

First Experiments

Initial experiments on the production of calcium metal were undertaken largely as a matter of academic interest. Since the time and efforts of the entire staff had been devoted to magnesium production, very little preliminary knowledge has been available for guidance. It had been known only that the reduction of alkaline earth oxides with aluminium had been proposed by several workers, and that the temperature-vapour pressure curve for calcium and the thermal balance of probable reactions indicated that metallic calcium might be produced under the conditions existing in the magnesium retorts.

While preliminary runs made in single retorts of magnesium furnaces were moderately successful, no further work was undertaken, as magnesium was at that time still on the critical list and neither time nor facilities were available for further study of calcium. The opportunity for continuation of the work was presented with the reduction of magnesium production early in the autumn of last year. In the meantime, inquiry had indicated that there might be a substantial demand in the metallurgical and chemical industries for high-purity calcium metal at the economic basis made possible by this process. A limited programme was, therefore, laid out for experimental production.

In normal times, the initiation and development of commercial production would doubtless have been slow. However, within a few weeks knowledge of this development reached the U.S. Army Signal Corps which was confronted with the necessity of obtaining large quantities of calcium hydride to be used as a portable source of hydrogen for the inflation of weather observation balloons. This demand, coupled with some production for industry in general, resulted in the conversion of a substantial portion of

the plant from magnesium to calcium. The present output is believed to be well in excess of 1944 world production.

In this discussion of the process, doubtless much of the information set forth will be familiar to those who have knowledge of the Pidgeon process for the production of magnesium by the reduction of calcined dolomite with ferro-silicon under vacuum. However, any description which did not cover this ground would be of little interest to those not acquainted with magnesium.

The primary material entering into the process is calcium oxide. A cheap product of adequate purity is obtained by calcining the natural limestone from the Adams quarries. A typical analysis of both the stone and the calcine are given in the accompanying table.

	Limestone, per cent.	Calcine, per cent.
Loss on ignition ...	43.71	0.50
CaO	55.19	97.55
SiO ₂ and insolubles	0.40	0.70
Fe ₂ O ₃ , Al ₂ O ₃	0.34	0.60
MgO	0.36	0.65
Na ₂ O, K ₂ O	0.005	0.009

Stone is calcined in rotary kilns and is either ground to approximately 60 per cent. -200 mesh, in Raymond mills, or shipped to Canaan as granular lime to be ground.

Aluminium Reducing Agent

The reducing agent which has been found to be most satisfactory is aluminium powder of reasonably high purity. Fortunately, the bag-collector dust produced as a waste product in the preparation of aluminium powder by atomisation of virgin aluminium has proved to be a source of material pure enough for general use and in adequate supply at an economic price. This is, typically, 96-99 per cent. aluminium, the principal impurities being iron and aluminium oxide. Atomised secondary metal may be used provided that the lower boiling metals, notably magnesium or zinc, are not present in substantial amounts.

Calcined lime is stored in a bin from which it is discharged into a batch weigher. Aluminium is received in drums which are discharged through special funnel heads into a small hopper with a closed top to avoid dust explosions. This also discharges into the batch weighing hopper. From the weighing hopper the raw materials are discharged by gravity into vertical-shaft muller roll mixers. The mix is conveyed by means of a screw conveyor to a bucket elevator, which discharges into a storage hopper over a Komarek-Greaves

roll-type briquetting press. It is necessary to briquette without the aid of binding media, since the distillation of these would interfere with the establishment of vacuum later in the process and likewise, if of organic base, would react with the calcium metal to form calcium carbide. However, at pressures of 80 to 90 tons per sq. in., coherent briquettes of reasonable mechanical strength are secured.

For convenience in charging, and to secure some degree of protection from atmospheric humidity during the interval between briquetting and furnace charging, the briquettes are bagged in manila paper upon discharge from the press, and placed on carts for delivery to the furnaces.

Furnace Design

The regenerative type automatic reversing furnaces are fired with producer gas having a heat value of about 150 B.Th.U. per cu. ft. Each contains 20 horizontal retorts of 15/28 Ni-Cr alloy 10 in. in diameter with a 1½-in. wall. Retorts are indirectly heated, a carborundum floor serving to prevent contact with combustion gases and to avert unduly rapid oxidation. The hot zone of the retorts in which reduction and distillation take place is 8 ft. long. Extending through the wall of the furnace are the cold ends in which the metal is condensed. These are 2 ft. long and are of mild steel with a water jacket extending back 12 in. from the face. The water jacket provides cooling capacity for condensation of the metal from the vapour phase and also serves to protect the rubber sealing gasket on the head plate.

For the purposes of the vacuum system, retorts are joined by headers into five banks of four retorts each. Each header is connected through 4-in. steel pipe with welded joints to a two-stage vacuum pumping system. The first stage is used to exhaust the retorts initially. Vacuum is provided by two mechanical pumps, each having a capacity of 100 cu. ft. per minute. A glass cloth filter in the line between the headers and the pump serves to catch any briquette dust drawn into the system.

The second stage line is connected through a mercury diffusion pump to mechanical pumps having a capacity of 100 cu. ft. per min. It is used to maintain low vacuum throughout the operation cycle after the initial evacuation. By means of suitable piping arrangement and valves, mechanical pumps may be used on either stage as stand-bys. Each retort, each pump, and both lines may be isolated from the rest of the system by valves.

Mechanical pumps are provided with an oil seal by means of a continuous supply of circulating oil. Oil from the return line is filtered through a bed of diatomaceous earth, passed through an electrically heated

reclaimer to remove moisture, and returned to a storage tank for recirculation.

Returning to process operation, bagged briquettes are charged into the furnace retorts using a loading chute and charge bar. Removable condensers made of steel pipe 10 in. in diameter by 20 in. in length are placed in the cold end chamber. Next the "sodium-shields," which are baffle plates designed to effect selective condensation of low-boiling sodium and potassium, are placed in position toward the outer end of the condenser. As soon as the flame from the paper bag dies down, head plates are seated by first opening the retort valves on each bank, and then the valves on the roughing line.

All retorts are drawn down to a pressure of about 400 μ . This requires 1-2 hr. depending upon moisture content of the lime and residual CO₂. Slow draw-down is indicative of leaks in lines, head gaskets, or retorts, which must be isolated and corrected. When the 400 μ level is reached, the furnace is cut over on the second vacuum stage and pressures of 20 μ or less should be obtained within 2½-3 hrs. of the sealing of the heads.

Recording Instruments

Roughing vacuums are determined periodically by means of a McLeod type mercury gauge connected to the roughing line. Second stage vacuum is indicated once every 5 min. on each bank by an automatic recorder actuated by a thermocouple in the vacuum line. Leaks are immediately indicated and may be isolated and repaired. Failure to maintain vacuum results in low yields, poor apparent density of deposited metal, and excessive formation of oxide and nitride. Furnace temperatures are controlled automatically, gas pressure being reduced as the temperature rises. Discharging of the furnace and charging of the retorts lowers the temperature of the furnace 55° to 85° C., and 3-4 hrs. are required to recover to a maximum of 1200°C., which is set not as a matter of reaction efficiency, but rather as a maximum to avoid early retort collapse.

Calcium is liberated in the hot section of the retort and passes to the cold end by diffusion, where it is condensed from the vapour to the solid phase. The operating cycle may vary from 8 to 24 hrs. At the end, the line valve is closed and the vacuum broken by means of a bleed valve in each header. Heads are removed; condensers drawn from the furnace with drawbars and piled on carts. The residue is drawn from the retorts with alloy scoops and dumped into hoppers beneath each retort which are, in turn, periodically discharged into dump trucks.

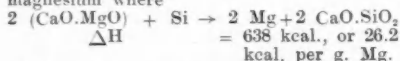
The metal, upon removal from the condensers, is in the form of hollow cylinders with one end closed. It consists of crystal

masses grown from the nuclei of initial deposits on the condenser surface. Calcium crystals tend to be more dense and definitely formed than magnesium, and tend to grow towards the hot end of the retort, rather than perpendicular to the condenser surface. The cool crystals have a very thin film of oxide or nitride, apparently formed immediately the vacuum is broken, which effectively inhibits further oxidation or nitriding in contact with air during cooling. The film is iridescent giving beautiful refractory colours, usually blue or violet, but occasionally red or golden.

The cylinders of metal are packed immediately for shipment or are crushed on a hydraulic press. With moderate heating, crystals may be extruded into bars which, while lacking structural strength, are convenient to handle in cutting exact weights of metal for alloying additions, and to machine in producing turnings, which are the preferred form for the chemical industries because of their high specific surface.

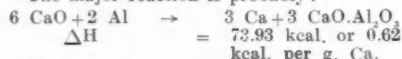
Reaction Mechanism

The mechanism of the reaction is at present neither clearly defined nor well understood. Observation of furnace behaviour indicates that the reaction is endothermic, but to a lesser degree than is the case with magnesium where



The residue contains unreacted aluminium, unliberated metallic calcium, and probably some unreacted lime in addition to true end-products, making even an approximate analysis quite difficult. Neither laboratory manpower nor facilities have been available for any considerable study of the residues nor of the principles of the reaction. From the limited amount of work done, and from study of furnace efficiencies, it would appear that several reactions take place simultaneously.

The major reaction is probably:



Control limits on the purity of raw materials are dictated by both operating conditions and the ultimate purity of the product as required by its final use. Moisture and residual CO_2 in the calcine delay the establishment of high vacuum, as both are evolved in the heating of the charge. Excessive alkali metal content in the lime interferes with rapid deposition in the condenser and results in spongy metal. In addition, these metals ignite spontaneously when vacuum is broken at discharge, resulting in some hazard to workmen where condensers are stuck.

Low-boiling metals normally encountered as impurities or alloying ingredients in lime

and aluminium are magnesium, zinc, and manganese. Magnesium and zinc tend to distil in the early stages of the reaction and concentrate at the interface between the deposited metal and the condenser surface. Only a portion of the lower-boiling metals contained in the charge diffuses to the cold end and becomes incorporated in the product, a substantial portion being absorbed or filtered out by the briquette structure.

Oxide and nitride are, in general, concentrated in the initial deposit, and also exist as a very thin film on the surface of the crystals. Metal made in a retort having a slight leak will have some nitride and oxide distributed throughout the mass, but these are readily detected by the appearance of the metal upon removal from the furnace.

A small amount of aluminium tends to distil over, or is swept over as vapour along with calcium and is found in highest amount at the tip of the crystals. Other metals appear as spectrographic traces.

Owing to the difficulty of obtaining truly representative samples, no accurate typical analysis of the calcium metal produced by this process can be given, but it is believed that the following are approximate percentages: Calcium, 98-99; magnesium, 1.0 maximum; aluminium, .2 maximum; copper, .005-.01; lead, .005-.01; zinc, .005-.02; nickel, .005-.01; silicon, .005-.01; manganese, .005-.02; iron, .002-.004; cadmium, .0005-.001; chlorine, not present; nitrogen, .02 maximum; calcium hydroxide, dependent upon age and exposure of metal to atmospheric humidity—not subject to determination by analysis in fresh metal.

A newly produced catalogue, published by GEORGE KENT, LTD., Luton and London (Publication 897/541) is devoted to the company's Multelec pyrometers. The instruments described are of the potentiometric type, for indicating, recording, signalling, or controlling. The control mechanisms range from the simple "On-Off" type to the "Variable Speed Floating and Proportional" type, which proportions heat input to demand and maintains "straight line" control. Each installation is completed by valves and motorised units, designed for every type of control and ensuring optimum results for every application. In addition to the usual control of temperatures, the Multelec instrument may be applied to pH measurement and control, to the control of boiler feed treatment, to the measurement of CO_2 , and to electrolytic conductivity measurement.

The Turkish Government has, according to a Swiss report, given permission to British and American oil interests to carry out investigations of territories likely to yield oil.

Canada's Work on Atomic Energy*

New Plant Under Construction

CANADA has been associated with scientific development in the field of atomic energy since the time when Rutherford began his investigations on radioactivity in McGill University in 1899. Investigations were, however, confined to university laboratories until the outbreak of war in 1939. From that time, the interests of scientists working on this subject in Britain, the United States, Canada and France were directed to the possibility of a practical application. With the fall of France, French scientists working on the problem were sent by Professor Joliot to join the British scientists. In October, 1940, information on this and other war research was interchanged between Britain, the United States and Canada. Towards the end of 1942, the British proposed that an important section of the work should be carried on in Canada as a joint enterprise. Accordingly, a joint laboratory of United Kingdom and Canadian staff was established in Montreal under the administration of the National Research Council. This laboratory now possesses a staff of over 340, by far the largest organization ever created in Canada to carry out a single research project.

Plant at Petawawa

As a result of agreements reached between the three partner governments, the work of this laboratory was closely co-ordinated with the tremendous research activity in this field in the United States.

Its work led to the design of a pilot plant for the production of atomic bomb materials, now under construction at Petawawa, Ontario, by Defence Industries, Limited, as a part of the combined United Kingdom-United States-Canadian programme. A branch of the National Research Council will be established there in close association with the pilot plant to carry out research on the application of atomic energy in war and in industry, and on the use of its products in research and medicine.

The plant which is being built near Petawawa to produce materials for release of atomic energy will contain uranium and heavy water. When these materials are brought together in certain proportions and in sufficient quantity, chains of fissions are set up and large quantities of energy are released from the uranium in a controlled and non-explosive way.

The basic process in the Petawawa plant is the production of fission in uranium 235 by a slow neutron. The fission of a U-235 atom releases high-speed neutrons; these

collide with the heavy water molecules without being absorbed and so they lose speed until they in turn produce fission. In this way a slow neutron "chain reaction" is set up. This results in very large numbers of neutrons being set free. Some of these neutrons are absorbed in the U-238 atoms to produce plutonium. Later, the uranium can be removed from the plant and the plutonium extracted chemically.

Future Possibilities

Other neutrons can be absorbed in materials placed round the reacting uranium. By this means, interesting new radioactive materials can be produced in large quantities. The plant will therefore be a source of supply of such materials for the study of chemical and biological processes and for application in medicine.

Some of the energy of fission is released in the form of fast neutrons and energetic gamma radiation. The reacting uranium must therefore be surrounded with a great thickness of material to absorb the neutrons in order to protect the working personnel from injurious effects. The intensity of the fast neutron radiations is much greater than any previously available to physicists and presents great possibilities for research.

The greater part of the energy of fission appears in the form of heat generated in the uranium metal. This heat has to be removed by rapidly-flowing water or gas. The metal surface temperatures are too low at present for this heat to be used effectively for the generation of power, but there is a possibility that this limitation may be removed by further work.

The design of uranium fission plants presents technical problems entirely different from anything previously encountered in industrial and engineering experience. It requires the combined knowledge and training of experimental and mathematical physicists, chemists and engineers and experts in other sciences. Every important feature of design has been based on difficult calculation, measurement and experiment.

This work for the Canadian plant has been carried out by the Montreal Laboratory, aided by such experience and information from the U.S. project as was authorised by agreement. The laboratory presented the basic data to Defence Industries, Limited, who have prepared detailed designs for the construction by the Fraser Brace Company.

A Distinguished Team

Some biographical notes of the leading workers on atomic energy at the Montreal Laboratory are appended.

DR. C. J. MACKENZIE, acting president

* From *Canadian Chemistry and Process Industries*, August, 1945, 29, 554.

of the National Research Council since 1939, was confirmed president in May this year. He is the Canadian representative on the Joint Technical Committee for co-ordinating the work on uranium and atomic energy in the joint programme of the three nations.

PROFESSOR J. D. COCKCROFT, Jacksonian Professor of Natural Philosophy, University of Cambridge, went to Canada in April, 1944, to assume the duties of director of the Montreal Laboratory.

DR. E. W. R. STEACIE, deputy director of the Montreal Laboratory, National Research Council, was appointed Associate Professor of Chemistry at McGill in 1937 and has been director of the Chemistry Division of the National Research Council since 1939.

DR. PIERRE AUGER, born in 1902, is foremost among the younger generation of French physicists and is a professor at the Sorbonne. After the fall of France he accepted a visiting professorship at the University of Chicago and later joined the N.R.C. project. He recently took over the position of Directeur de l'Enseignement Supérieur in the Ministry of National Education in Paris, after completing his work at Montreal.

An Escape from France

DR. H. H. HALBAN led the first group of scientists to arrive in Canada from the United Kingdom, and to him fell the task of organising the Montreal Laboratory. With **DR. L. KOWARSKI**, who has recently joined the Montreal Laboratory, he participated in pioneer research on uranium fission under Professor Joliot in the Collège de France. The escape of these two French physicists from Bordeaux to England was accomplished by the Earl of Suffolk. They were able to bring with them the greater part of the world's supply of "heavy water," which the French Government had bought from the Norsk Hydro Company just before the invasion of Norway.

DR. G. C. LAURENCE began the research in the National Research Laboratories on uranium fission in 1940. He was joined in this work the following spring by **PROFESSOR B. W. SARGENT**. Both of them were Exhibition of 1851 Scholars in the Cavendish Laboratory of Cambridge University.

PROFESSOR F. A. PANETH, born in Vienna, left Germany after the accession of the Nazis to power, and is now head of the chemistry department at the University of Durham.

DR. GEORGE PLACZEK, a native of Brno, Czechoslovakia, carried on his work on theoretical atomic and molecular physics at Utrecht, Leipzig and Rome, and worked with Bohr at Copenhagen. He came to the Montreal Laboratory in 1942, and was head of the Theoretical Physics Division until his transfer in May, 1945.

PROFESSOR G. M. VOLKOFF directs the

theoretical and mathematical work of the Montreal Laboratory. His services have been lent to the project by the University of British Columbia. He was born in Moscow, but moved to Canada in 1924 and became naturalised in 1935. He has worked, at Princeton University and the University of California, on the forces within the nucleus of the atom responsible for the energy released in radioactivity and in uranium fission.

MR. R. E. NEWELL, who directed the basic engineering design of the Petawawa plant, was born in England and was educated at the University of Cambridge. He was associated with Metropolitan-Vickers from 1927-28, and from then until he joined the Montreal Laboratory in 1942 was a member of the staff of I.C.I. responsible for the design of gasoline plants and ammonium plants. In 1941 he was a consultant on a uranium research project in England.

SURGEON-COMMANDER C. B. PIERCE, R.C.N.V.R., is head of the Medical Section of the Montreal Laboratory, engaged in research on the effects of radiation on living materials and in the application in medicine of radioactive materials to be made at Petawawa. Associated with him is **DR. J. S. MITCHELL**, who is the Medical Officer in Charge of the Radiotherapeutic Centre, Addenbrooke's Hospital, Cambridge.

In addition to those mentioned, the largest and most distinguished group of scientists ever assembled for a single investigation in any British country has worked in Canada on the experimental and development work on atomic energy.

ENDEAVOUR

The current number of *Endeavour* is one of the most interesting that has yet appeared, at any rate to the chemist. **DR. R. E. SLADE** informs his readers of the present position regarding the specificity of poisons, with particular reference to methoxone and gammexane. There is a wide field of study here for physiological chemists. **DR. H. W. THOMPSON** deals with the remarkable new developments in chemical spectroscopy, and his observations on the technique of the vibration spectra of large molecules, with infra-red absorption, is particularly fascinating. This new analytical method, as he says, promises to have wide applicability in organic chemistry. More specialised, and even more immediately striking, are the hitherto unpublished experiments carried out by **DR. ALEXANDER HADDOW**, **DR. K. M. RUDALL** *et al.* on the artificial coloration of animals' coats. The non-chemical articles reach an equally high standard, and the illustrations are of the excellent quality that we have been trained to expect.

Drinking Water from Sea Water

The Work of the Royal Naval Scientific Service

THE problem of procuring drinking water on life-rafts in order to prolong survival after shipwreck or air crash is of fundamental importance and considerable attention has been devoted to its solution. Sea water contains the majority of the common elements in small amounts, the principal ions being chlorine and sodium; others are calcium, magnesium, and potassium, and dissolved gases, *e.g.*, oxygen, nitrogen, carbon dioxide. The salinity holds a constant relation to the chlorine content and varies between 32 and 37.4 parts per thousand in the open sea. The mean surface temperatures of the Pacific and Atlantic Oceans is 17°C.; that of the Indian Ocean 18°C. Maximum temperatures are respectively 32°C., 30°C., and 35°C.

An analysis of sea water shows that it has the following approximate composition:

	<i>p.p.m.</i>
Calcium bicarbonate $\text{Ca}(\text{HCO}_3)_2$	180
Calcium sulphate CaSO_4	1220
Magnesium sulphate MgSO_4	1960
Magnesium chloride MgCl_2	330
Sodium chloride NaCl	25,620

Total dissolved solids 32,280

Early Methods

Early work on rendering sea water potable was confined to physical methods involving the use of stills. These methods are, on the whole, unsuitable for use on small rafts and practically impossible to mount in the rubber dinghies carried by aircraft. Among such methods may be cited the Visscher Body Still, which consisted of a vacuum pump to reduce pressure in the system, and of a small boiler strapped to the body, the heat of which acted as a fuel to distil fresh from sea water, condensation being effected by immersing a coil and collecting bottle in the sea. This still needed the expenditure of considerable muscular energy to maintain the reduced pressure and in low temperatures the individual could ill afford to lose the body heat demanded for evaporation of the water. The amount of pure water resulting was low.

The Armbrust Cup followed last-war methods whereby moisture in the breath is condensed in a wet felt-jacketed metal container. The calculated efficiency peak for such a method is 15 ml. of water per hour, but this was never reached in laboratory and field tests; a maximum of 5 ml. per hour was attained; no subject was found who could tolerate the device for 8 hours.

The Delano Solar Still makes use of solar radiation; the sunlight passes through a transparent plastic window and is absorbed

by black towelling which backs up the plastic sheet. The towelling is kept wet with sea water, the evaporating moisture condenses on the window and drains into a reservoir. Under ideal conditions the apparatus was capable of producing 300 ml. of water a day, but was much too fragile for use on a life-raft. As it needed to be oriented to the sun, its efficiency greatly decreased on a cloudy day.

Later Developments

In 1941, the Inventions Section of S.R.E. Department was inundated with schemes suggested by inventors, most of which were found to be either quite impracticable or to fail to achieve the result claimed. Accordingly, in July, 1941, the Director of Scientific Research, after consideration of the importance of this problem and its many factors, asked a member of his staff to approach the Permutit Company and request them to investigate the application of exchange materials to the problem.

Work was confined at first to the improvement of stills for use in lifeboats, where there is reasonable space to carry a special form of still heated by briquettes of coal, and one design has been supplied, through the Ministry of War Transport, to all merchant vessels travelling in dangerous waters; but stills, obviously, are quite unsuitable for use by baled-out airmen and their requirements have been met by a process which does not depend on heat and distillation.

Chemical processes were examined, the Government Laboratory, for example, producing a method which showed considerable promise, but necessitated the use of three stages.

Reactions Used

$\text{Ba}(\text{OH})_2 + \text{MgSO}_4 = \text{BaSO}_4 + \text{Mg}(\text{OH})_2$	(1)
$2\text{Ag}(\text{OH}) + \text{MgCl}_2 = 2\text{AgCl} + \text{Mg}(\text{OH})_2$	(2)
$\text{AgZ} + \text{NaCl} = \text{AgCl} + \text{NaZ}$	(3)
<i>Reagents Required for 100 ml. Sea Water</i>	
Barium hydrate $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$	0.80 gm.
Silver oxide Ag_2O	0.35 gm.
Sodium aluminate (as coagulant)	0.05 gm.
Zeo. Carb. Ag	34.00 gm.

Total weight	35.20 gm.
Bulk volume	40.0 ml.

The method of treatment is to add to the sea water the barium hydrate, silver oxide, and sodium aluminate, and to shake for 15 min. The silver zeolite is then added and the vessel shaken occasionally for 30 min. The water is then drawn off through a filter by mouth suction when required. The yield obtained from 250 ml.

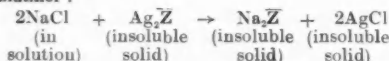
of sea water treated with 100 ml. of reagent was 210 ml. of water drawn off under a suction of 10 in. mercury (it was found that 14 in. mercury was easily attained by mouth suction). This water contained 284 parts chlorine per 100,000, equivalent to 0.46 per cent. sodium chloride. Barium and silver were absent.

First Chemical Method

A possible first step towards development of a chemical method was made when B. A. Adams and E. L. Holmes, working in the laboratories of the D.S.I.R., developed resins of two types. When water was passed through a resin of the first type and then through a resin of the second type, dissolved salts were removed from it. When applied to sea water, containing as it does approximately $3\frac{1}{2}$ per cent. of dissolved salts, the yield of purified water was less than the volume of the apparatus required to produce it and, although this method was demonstrated at the Royal Institution Convegazione in May, 1934, it could only be regarded as of academic interest.

The method finally adopted for the purification of sea water in boats and on rafts and rubber dinghies was developed in principle as a result of tests carried out for precious metal recovery by the Permutit Company before the war, using ion exchange materials. These materials are normally used in water softening, using the reversible exchange (2Na^+) for (Ca^{++}) and (Mg^{++}), but have applications in chemical process work.

An ion exchange material was made having exchangeable silver (silver zeolite). This material was found to react with sodium chloride solutions in the following manner:



Thus, by treating a solution of a soluble chloride with silver zeolite, an insoluble sodium zeolite and insoluble silver chloride are formed. This process resulted in the complete removal of soluble chlorides from the water. Owing to the insoluble nature of the silver zeolite, an excess of this reagent cannot do any harm and silver ions could not be detected in the water left after treatment. It was found that a percolation technique of passing the water through a column of the silver zeolite was impracticable owing to the formation of the silver chloride precipitate. For this reason a shaking technique was adopted and the chloride solution and powdered silver zeolite were shaken to break up the precipitate formed. This technique gave excellent results for chloride removal.

Similar experiments on sodium sulphate solutions were carried out using ion ex-

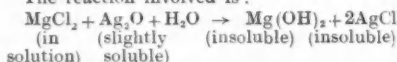
change material containing exchangeable barium (barium zeolite). In this case insoluble sodium zeolite and insoluble barium sulphate were formed and again the shaking technique was essential. This method preserved the automatic character of the chloride removal process in that it was not necessary to be concerned about excess barium zeolite as this did not produce free barium ions in the treated water.

Barium-Silver Zeolite

These experiments were then extended to sea water and it was found that a mixture of silver zeolite and barium zeolite would effectively remove the dissolved chlorides and sulphates. The next step was to combine the silver and barium zeolites by making a mixed barium-silver zeolite. This is an ion exchange material containing both exchangeable barium and exchangeable silver. By regulating the proportion of barium to silver ions in the manufacture, this mixed zeolite can be used for removal of chlorides and sulphates simultaneously in the proportions in which they are found in sea water.

One other problem had to be solved in the treatment of sea water and that was the removal of the greater part of the magnesium ions. It was found that excellent magnesium removal could be obtained by making the mixed silver-barium zeolite by passing a solution of barium hydroxide through silver zeolite. In this way the mixed zeolite produced contained also a proportion of silver oxide. This was precipitated *in situ* and was very finely divided, and this silver oxide was more effective in the removal of magnesium than an artificial admixture of silver oxide with either the mixed or the separate zeolites.

The reaction involved is:



The mode of treatment having been settled, the practical details proved a further obstacle, as it was necessary to get a maximum yield of drinking water from a minimum of space. Consequently, the chemical reagents were compressed into compact briquettes, becoming rock-hard. A disrupting agent had to be incorporated: a material which, on coming into contact with water, increases its volume and thus breaks up the rock-hard pellets to a powder. The technical difficulties in making these briquettes and in obtaining the correct disrupting agent were considerable, and in this connection credit must be given to the D.S.I.R. for finding a satisfactory disrupter which was subsequently further improved by the Permutit Company. The disrupter finally accepted for use was an activated fullers' earth which gives automatic disrupt-

tion of the chemical charges on coming into contact with water under all conditions.

Swelling and Briquetting

During the investigation of the disruption of the briquettes a further advantage of the mixed zeolite came to light. Tests had previously been carried out on various sulphate-removing agents, the most notable reagents of this type being barium oxide and barium hydroxide octahydrate. These reagents have the advantage over barium zeolite that they will remove more sulphates per unit weight. When, however, they were incorporated in the mixture, it was found that barium oxide gave rise to swelling of the briquettes subsequent to the compression process. This was a great disadvantage, since the chemicals must be packed tightly into a container and any swelling results in the impossibility of extracting them for use. When barium hydroxide octahydrate was used, there was no swelling after briquetting, but after keeping for a few weeks the chemical charges proved to be impossible to disrupt. Much investigation was devoted to this point, but the development of the mixed zeolite described above overcame the difficulties, as this reagent causes neither swelling after briquetting nor difficulty in disruption.

The final reagent, therefore, consists of mixed barium-silver zeolite containing a quantity of precipitated silver oxide together with a disrupter. In addition, a very small amount of activated carbon has been incorporated in the briquettes to produce a clear bright drinking water at all times. It was found that when the chemical charges were stored under tropical conditions there was a tendency to produce a yellowish drinking water, somewhat unattractive in appearance. The incorporation of the small percentage of activated carbon in the briquettes overcomes this disadvantage and has a considerable psychological value. To facilitate the smooth operation of the briquetting process a small amount of graphite is added to the chemical mixture.

The best method of obtaining a clear drinking water was found to treat sea water and briquettes in a flexible bag fitted with a permanent filter cloth. After shaking up the sea water and the chemical reagents, the drinking water can be filtered by squeezing the flexible bag so that water passes through the filter cloth. All the suspended precipitates and zeolites are retained, and a clear drinking water is produced. This is squeezed out into a transparent plastic box and, in view of the fact that the apparatus may be subjected to a range of temperatures between -50° and $+75^{\circ}\text{C}.$, with a possible relative humidity of 90 per cent., it was essential to obtain a material suitable for these conditions. Two types of plastics have been used: (a) cellulose acetate, and

(b) Perspex. The latter is the more satisfactory, as it stands up completely to all the physical conditions. The cellulose acetate tends to become distorted at the higher range of temperature and its use has been discontinued. The Perspex has the disadvantage of being more brittle than the cellulose acetate, but this difficulty has been overcome by careful packing.

Final Apparatus

The apparatus as established consists of a flexible purifier made of rubberised fabric, nine chemical charges which are enclosed in a rubberised fabric storage bag to keep them dry during storage and also during the use of the apparatus, and a Perspex drinking box into which the rest of the equipment is packed. Each chemical charge will produce $\frac{1}{2}$ pint of drinking water from sea water so that the apparatus will produce $4\frac{1}{2}$ pints of drinking water. Its overall size is 3 in. by 3 in. by $4\frac{1}{2}$ in., so that it will be seen that it produces several times its own volume of drinking water.

The foregoing successful method, developed by the Permutit Company, Ltd., was closely followed by the American Permutit Company, who have developed a form of equipment for the U.S. Army and Naval Air Forces.

So successful has this method proved that an initial order for 340,000 sets was placed on Admiralty and R.A.F. behalf. The need for this equipment can be seen from the fact that in Home Waters only in 1943, 1684 airmen were rescued from the sea after having been ditched from their aircraft, and this apparatus has already saved many lives. A further development is in the equipping of Carley Floats for use in destroyers and other war vessels. More recently the highest priority has been given to an initial order of many thousands of special packs (7 in. by $3\frac{1}{2}$ in. by 1 in.) for the use of fighter pilots. This pack is a modification of the main kit and is about the size of a pocket camera. It consists of a bag containing the briquettes between two sheets of bright aluminium (which latter can be used for reflection purposes if necessary). Each kit is capable of producing three pints of drinking water.

The Estonian State Defence Committee has decided that the country's shale-oil industry is to become the basis of Estonia's industrialisation. Shale refined will be consumed chiefly by industrial plants in the country or in the Leningrad area. About twenty large mines are to be opened up within the next three years and two large-scale plants will be erected within the next four years to produce gas from shale. Moreover, a 262-kilometre pipe-line will be laid to Leningrad.

Vacuum Technique

The Evaporation of Liquids

THE new session of the North-Western branch of The Institution of Chemical Engineers was opened at the College of Technology, Manchester, on October 13, by Mr. Hugh Griffiths, president of the Institution, who presented a paper on "Some Problems of Vacuum Technique from a Chemical Engineering Standpoint."

Having reviewed the theoretical and the empirical approaches to chemical engineering and its relation to mathematics and physics, the president dealt with the problems of vacuum technique as applied to the evaporation of liquids under vacuum, with particular reference to the sizes of the vapour pipe, of the pipe from the condenser to the pump, and the type, size and power of the pump. Because of inadequate data on the physical properties of vapours at low temperatures and at low pressures, a general solution of the size of the vapour pipe could not be made; preliminary estimations of the sizes of the entry to the vapour pipe, of its middle portion and of the exit to the condenser were given, different data being used to cover five ranges of absolute pressures from 150 to 0.1 mm. of mercury. Ranges of absolute pressure between 0.1 and 0.001 mm. of mercury needed special treatment and, in general, these pressures were not used on a large scale.

The size of the pipe between the condenser and the vacuum pump is governed by the size and type of pump chosen; this pipe carries permanent gases which arise from the decomposition of the evaporated liquid and from leaks in the system, these gases being saturated with vapour at the temperature of the exit from the condenser. For ordinary vacua the same methods and formulae may be used for the calculation of the size of this pipe as for the size of the vapour pipe, but for high vacua Knudson's method is used. The design of vapour traps in this pipe should be carefully considered.

Characteristics of Pumps

In choosing the vacuum pump, the relation between volumetric efficiency and absolute pressure, also the typical rate of exhaust curve, should be known. The pump should be able to produce an end vacuum greater than that required, and the conditions of testing the end vacuum of high-vacuum pumps should be ascertained. Sizes and characteristics of wet, and of dry-vacuum pumps, steam-jet and diffusion pumps were given, with some special points of interest. Approximate methods for calculating their times of exhaust were stated and it was noted that information from the pump manufacturer on size and power consumption is more satisfactory than theoretical calculations. Steam-jet pumps are preferably

used only for maintaining the desired pressures, and diffusion pumps cannot be used for exhausting from atmospheric pressure. A diagram of a device for withdrawing fractions from distilling plants under vacuum was shown.

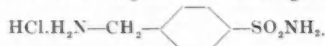
In conclusion, the speaker emphasised the great value of the theoretical approach to chemical engineering problems; the essential data may not merely be unavailable, but, by reason of the complex nature of the problems and the larger number of variables, the solution is difficult to deduce from measurements.

A Potent Antibacterial

British Manufacture of Marfanil

MARFANIL, which was the German Army's most potent drug for the treatment of wounds, and was removed from its pre-eminent status only by the Allied development of penicillin, is now being manufactured in this country by R. F. Reed, Ltd., Riverside Works, Hertford Road, Barking, Essex, and will soon be available in several different packings.

The name Marfanil has been given to *p*-aminomethylbenzene-sulphonamide hydrochloride, a drug, which (with its derivatives) differs from the sulphanilamides by the presence of a methylene group between the benzene ring and the amino group:



Its outstanding characteristic is that it is not inhibited by *p*-aminobenzoic acid, in the presence of large concentrations of which the sulphanilamides lose their activity against bacteria. Also, it is not inhibited by pus, is unique in its activity against anaerobic bacteria, and is active against sulphanilamide-resistant strains of bacteria. It is notable also for its great solubility (1 part in 2.5 parts cold water), its remarkable stability—wherein it shows superiority even to penicillin—and its extremely low toxicity.

It has been applied with outstanding success in cases of gas gangrene, and in powders mixed with sulphanilamide or sulphathiazole is recommended against a wide range of infections. It has been authoritatively stated in the *Lancet* that penicillin used in conjunction with Marfanil may give better results than when it is mixed with sulphonamide or sulphathiazole. Research on the less soluble derivatives of Marfanil, now in progress, is expected to yield interesting results.

An Austro-Hungarian trade agreement provides for the delivery of Hungarian coal and coke to Austria.

Personal Notes

The appointment of **MR. N. K. LINDSAY** as the first director of the British Non-Ferrous Metals Federation takes effect from December 1 next.

MR. F. C. BAGNALL has been appointed managing director of British Nylon Spinners, Ltd., Coventry. He was formerly director and general manager.

The title of Reader in Analytical Chemistry in the University of London has been conferred on **MR. L. S. THEOBALD** in respect of the post now held by him at the Imperial College of Science and Technology.

DR. G. A. H. BUTTLE has been appointed to the London University Chair of Pharmacology, tenable at the College of the Pharmaceutical Society of Great Britain as from October 1, 1945.

The delegation from the Indian Chemical Manufacturers' Association, at present in this country, is composed of **MR. R. B. AMIN**, **MR. L. GUPTA**, **DR. K. A. HAMIED**, **MR. M. HANIF**, **MR. K. K. RAMAN**, and **MR. S. P. SEN**.

The Minister of Supply has agreed to release **SIR A. VYVYAN BOARD** from his appointment as Rubber Controller with effect from November 1. From the same date the Rubber Control is replaced by a Rubber Directorate in charge of **MR. J. RIDDELL**, and a Tyre Directorate in charge of **MR. H. J. HOLMES**.

MR. J. DAVIDSON PRATT, director and secretary, Association of British Chemical Manufacturers, and **MR. E. H. LEVER**, chairman, Richard Thomas & Co., Ltd., have been appointed, by Professor Marquand, secretary to the Overseas Trade Department, to be members of a special committee to advise the Minister on international exhibitions.

After five years' service in the Army **MR. E. GLANVILL BENN** has this week returned to Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE and 14 associated journals. He temporarily relinquished his duties as managing director to join the East Surrey Regiment, later went through the Staff College at Camberley, and for the past two years has been a Brigade Major in Italy. He comes back to Benn Brothers to take up new duties as chairman of the company.

The marriage of **MR. KEVIN G. FITZGERALD**, manager of the I.C.I. Dublin office, and **MISS JANET QUIGLEY**, took place at St. Pancras Registry Office, London, on October 24. Mr. Fitzgerald was for some years Agricultural Sales Manager for I.C.I. (South-Eastern Division), and his talks and readings, a favourite feature of the B.B.C.

London programme, were often "produced" by Miss Quigley as an executive of the B.B.C. programme staff.

MR. T. M. WILLCOX, a delegate managing director of I.C.I. Dyestuffs Division, has been released in order that he may accept the post of general manager of the Clayton Aniline Co., Ltd. Mr. Willcox has been connected with the dyestuffs industry for some 20 years; he was formerly with the British Alizarine Company of Trafford Park, of which he was the general manager in 1931, when the company was purchased by I.C.I.

Obituary

MR. ORLANDO F. WEBER, founder and former president of the Allied Chemical and Dye Corporation, died on September 6 in New York City after a brief illness, aged 66.

PROFESSOR WILLIAM BURDELLE BENTLEY, 79, emeritus professor of chemistry, Ohio University, died suddenly on July 14 at Athens, Ohio, aged 79.

MR. FRED ENGLAND HOOPER, for many years general manager of Thomas Vickers, Ltd., manufacturers of superphosphate and fertiliser, of Widnes, died at Old Colwyn recently, aged 73.

MR. HERBERT THOMAS BUTCHER, A.R.S.M., F.R.I.C., died at Hadley Wood, Herts., on October 24, aged 75. He was elected an Associate of the Institute of Chemistry in 1891, and graduated to the Fellowship in 1898.

CHEMICAL COUNCILLORS

The chemical industry is well represented in the newly-elected Borough Council of the famous chemical borough of Widnes. Of the eleven candidates returned last week eight are connected in one way or another with the industry. Labour has four representatives: **MR. J. GUY**, who is a welder with High Speed Steel Alloys; **MESSRS. J. F. TRAYNOR** and **J. FISHER**, who are both fitters with I.C.I.; and **MR. J. H. COLLINS**, B.Sc., who is on the I.C.I. laboratory research staff and who is an active member of the local branch of the A.Sc.W. The two Conservative councillors are **DR. J. P. BAXTER**, who is a director of I.C.I. and was a member of the British atomic bomb team; and **MR. J. N. ECCLESTON**, who is a clerk with I.C.I. The two Independents returned are **MR. I. P. LLEWELLYN**, M.B.E., M.I.Chem.E., a director of Peter Spence & Sons, and **MR. J. ASHLEY**, a member of the C.W.U. and a crane driver at Thomas Bolton & Sons. **MR. ASHLEY** and **MR. COLLINS**, who are both only 22 years old, will no doubt infuse a spirit of youthful vigour into the work of the Council.

Parliamentary Topics

I.C.I. Attacked

IN the course of a general attack on the prices charged to British industry for raw materials, as compared with the corresponding prices charged to American industry, Mr. Stanley Evans, Labour member for Wednesbury, during the Budget debate in the House of Commons, had some hard words to say about that popular target, I.C.I.

"We all know," he said, "the privileged position held in British industry by Imperial Chemical Industries. They have either knocked out or bought out every potential competitor, and are now in a position to charge what prices they like. It would appear that they are making hay while the sun shines. I want to give some percentage increases which British manufacturers are having to pay to this combine, as compared to their American competitors. For acetic anhydride, British manufacturers are having to pay 51 per cent. more; for acetone 67 per cent. more; for alcohol butyl 82 per cent. more; for benzene 172 per cent. more; for calcium carbide 44 per cent. more; for soda ash 49 per cent. more; for sulphur 106 per cent. more; and for sulphuric acid 108 per cent. more. I want to know how we can increase our exports by 50 per cent. over the pre-war figure if our manufacturers are to be penalised from the start by having to pay more than their competitors for the raw materials they require."

[In answer to the above criticism, Mr. R. A. Lynex, secretary of I.C.I., makes the following statement in a letter to *The Times*: "I.C.I. neither manufactures nor sells five of these eight materials. Of the remaining three, sulphur, far from being manufactured, is a raw material, mined abroad, and imported into Great Britain; the price of another, sulphuric acid, is controlled by H.M. Government, and I.C.I. produces not more than a quarter of the nation's output of that material; and the price of the third material, soda ash, is not subject to H.M. Government control, but the percentage difference between United Kingdom and United States of America prices for substantial quantities and comparable delivery and packing is well below the percentage quoted by him."]

Calcium Cyanide

Mr. Peter Freeman asked the President of the Board of Trade whether he was aware of the shortage of calcium cyanide for preventing eel-worm in potatoes; and if sufficient quantities were not available from Norway or elsewhere, would he consider the desirability of providing facilities for a factory to produce this fertiliser in Newport.

The Minister of Agriculture: No chemical treatment that is effective and economic is at present known for the control of this

pest. The only satisfactory procedure on infested land is to adopt a rotation in which potatoes are grown not more than once in three or four years.

Malayan Tin Industry

Viscountess Davidson asked the Minister of Supply what steps were being taken to enable the Malayan tin industry to resume production.

Mr. Wilmot: Representatives of the Ministry of Supply are in Malaya to purchase readily available tin ore and metal and to report on the condition of the smelters. An expert appointed to advise on the rehabilitation of the tin industry has submitted provisional plans and has now gone to Malaya, together with a committee representing the Malayan tin industry, to survey properties and equipment. Orders have been placed in this country by the Government for substantial quantities of equipment.

Census of Production

Replying to Mr. Mallalieu, who had asked what action was proposed on the Report of the Census of Production Committee, Sir Stafford Cripps said that the necessary legislation could not be undertaken this session, but it would be introduced as soon as practicable. It was hoped that a full census of production on the new basis would be taken for 1947. In the meantime, arrangements would be made to take a partial census for 1946 covering a limited number of industries.

Fog Dispersal

Mr. Peter Freeman asked the Minister of Fuel and Power whether any arrangements had been considered to make use of the equipment employed during the war for the dispersal of fog for civilian purposes, particularly at railway stations.

Mr. Shinwell: The Minister of War Transport is bringing this matter to the notice of the railway companies in order that they may consider whether it would be practicable for them to provide for fog dispersal. At present, however, the petrol supply position imposes a serious restriction.

Waste Collection

The Minister of Supply, questioned on the falling off in the collection of waste materials, said that encouragement was being given to the local authorities to intensify their salvage collections.

The Albert Gold Medal of the Royal Society of Arts was awarded last week to the Rt. Hon. Winston Churchill, M.P., the citation being that "his foresight, faith and fortitude led free men to victory."

General News

The manufacture of waxes from various by-products has been started at Blackpool.

The British Association of Chemists has published, in pamphlet form, Professor Harold Laski's lecture on "The Place of the Scientist in Post-War Administration."

The chemical, dyestuff and drug industries are included in the provisional list of industries to be covered by the proposed partial census of production.

The Postmaster General announces that surface and air mail correspondence can now be accepted for transmission to the whole of China except Manchuria.

An Infestation Conference, arranged under the auspices of the Emergency Economic Committee for Europe, was held in London last week.

The new address of Bamag, Ltd., from November 5, is Rickett Street, West Brompton, London, S.W.6. Telephone: FULham 7761; telegrams: BAMAG, WALGREEN, LONDON.

The name of Thomas Ovens and Sons, Ltd., manufacturers of chemical fertilisers and sulphuric acid, Leith and Bo'ness, has been changed to Fisons Limited, and the new addresses are Harvest House, 40 Timber Bush, Leith, and Harvest House, Bo'ness.

The Regional Production Boards have now been reconstituted by the President of the Board of Trade as Regional Boards for Industry. The Boards will exercise their activity over the whole field of industry instead of, as in the past, being chiefly concerned with munition production.

Grants to industrial research associations are to form a permanent part of the activities of the D.S.I.R. This was announced on Tuesday by Mr. Herbert Morrison, Lord President of the Council, as a step in the Government's policy of encouraging British industry to make use of scientific research.

The Minister of Food announces that the only change in existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users, during the four weeks ending December 1, is rape seed oil crude increased by £3 to £91 per ton naked ex-works.

A warning that fertilisers were still in very limited supply was given recently in Edinburgh by the Scottish Fertiliser Distribution Committee; the trade would, therefore, continue to operate under the present system of priorities and regulations. The situation on the Continent was such that continuous maximum production of fertilisers was essential.

From Week to Week

The report of the Percy Committee on Higher Technological Education was published on Wednesday by the Ministry of Education (H.M.S.O., 6d.). It emphasises the need to industry of scientists and technologists who can administer and organise, as well as apply in practice the results of research.

At the recent general meeting of the Parliamentary and Scientific Committee it was agreed that applications for membership from 92 Members of the new Parliament should be dealt with by electing them *en bloc*. The following were also elected: Rt. Hon. Sir John Anderson, M.P.; Earl of Mount Edgumbe; British Welding Research Association.

The Copper Development Association, which, during the war operated principally from a temporary office in Rugby, has now acquired premises at Kendals Hall, Radlett, Herts. (Tel.: Radlett 5616), to which applications for the Association's literature should be, in future, addressed. The Association will continue to maintain its registered address at Grand Buildings, Trafalgar Square, London, W.C.2.

Six workmen have been detained in hospital, as a result of an explosion which occurred last Sunday afternoon at the premises of Elliott and Crabtree, Ltd., starch and gum manufacturers, Miles Platting, Manchester. Most of them were suffering from burns resulting from their being splashed by process acid. The explosion, the cause of which is not known, did little damage to the plant, but the structural damage has been estimated at £15,000.

The Plastics Division of I.C.I. has leased some buildings at the former M.O.S. factory at Fleetwood, in Lancashire. Work is now proceeding on the necessary alterations, and limited production will start in the next month or two. It is expected that full production will be reached in about 18 months' time, giving employment to about 300 workers. The products to be made are nylon monofilaments, and products based on polyvinyl chloride and polythene.

The Import (Certificates of Origin and Interest) (Revocation) Order, 1945 (S.R. & O. 1945, No. 1316), revokes S.R. & O. 1939, No. 1505, whereby all goods imported into the U.K. from certain neutral countries (principally, Portugal, Spain, Sweden and Switzerland) had to be accompanied by a certificate signed by a British consular officer that no enemy had any interest in such goods, and that not more than 5 per cent. of their cost was due to enemy labour or raw materials.

Foreign News

Investigations have been completed for the establishment of a synthetic rubber industry in Argentina.

An Iron and Metal Research Institute has been established at the Stockholm Technical High School.

A new phosphate plant is in course of construction by the Melon Cement Company at Guayacan, Chile, at a cost of 50 million pesos.

The Muehlig-Union sheet glass plant in Czechoslovakia—one of the largest in Central Europe—has recently resumed production.

Representatives of the Polish National Bank, who are negotiating reconstruction loans in Sweden, have obtained a credit of Kr.100,000,000 for the Polish steel industry.

Portugal's tin output during the first half of the current year amounted to 128 tons, compared with about 300 tons in the first half of last year.

The Rumanian Foreign Trade Commissariat has approved the export of over 3000 tons of salt to neighbouring Yugoslavia and Hungary.

According to a provisional official report, stocks of tin concentrates in Siam are over 16,000 tons, and of tin metal about 4000 tons. The state of the mines is believed to be not unsatisfactory.

A number of chemical plants in Slovenia have resumed work, including the Ruse plant, where carbide, carbon dioxide, ammonia, etc., are being produced, the Hrasnik glass plant, and several dye works.

The erection of a sulphuric acid plant is being planned by the Palestine Potash Company. Two other industrial groups have also received concessions, by the Palestine administration, for the erection of sulphuric acid plants.

Brazil's pig-iron production totalled 122,685 tons, in the first six months of the current year, of which over 50 per cent. was used for steel manufacture. There are now 24 blast furnaces in the country, 19 of which are in Minas Geraes, four in Rio de Janeiro and one in Sao Paulo.

The Polish Council of Ministers has signed two supplements to the Polish-Rumanian trade agreement recently concluded in Moscow, providing for the exchange of Rumanian oil, manganese, and pit props, against Polish coal and coke, as well as for the transport of the commodities concerned.

In Saxony, all deposits of coal, ore, potash and oil, as well as all installations belonging to the coal and ore mining industries are to be nationalised. A draft plan to this effect has been accepted by the Administration of Saxony. No compensation will be paid, but the claims of municipal authorities and small owners will be assured by special legislation.

The Finnish State Alcohol Monopoly Company has established the O.Y. Alkoholilike A.B. in Pajjanne for the production of alcohol from wood sugar for automotive purposes.

New Zealand Government geologists have discovered occurrences of uranium after two years' survey. Evidence now being studied by a committee, headed by Professor Gordon J. Williams, Director of Otago School of Mines, appears to show that quantities of uranotorite, containing 11.5 per cent. of uranium and 60 per cent. of thorium, exist in the Dominion.

On the same date as the centenary celebrations of the Imperial College of Science in London—October 25—the Institut de France in Paris commemorated the 150th anniversary of its foundation in 1795. Four of the academies which it comprises were of much older foundation, including the Academy of Science (more or less corresponding to our Royal Society) which dates from 1666.

The Canadian Mines Handbook, 1945, published by Northern Miner Press, Ltd., 122 Richmond Street, Toronto, reflects the great volume of prospecting activity in recent years. The position of the operating companies is reviewed in detail, with five-year comparisons of output, earnings, etc. Particulars are also given of the active non-producing organisations. Altogether, 7100 companies are included.

The first meeting of the newly-constituted South African Council for Scientific and Industrial Research was held in Pretoria recently. General Smuts, in opening the meeting, said that the council would conduct research in the widest sense and would organise and administer research, create laboratories, and open universities. Professor Basil F. J. Schonland, F.R.S., is president of the council.

The Schott Works at Jena were recently inspected by a member of the firm of Chance Bros., Ltd., Smethwick, who found that whole output capacity was considerably larger than in this country, no revolutionary methods of manufacture were discovered. As regards new developments, Britain was ahead of the Germans both in methods of manufacture and in the production of new types of glass.

Speaking at a luncheon of the American-Scandinavian Foundation in New York on October 21 (Nobel's birthday), Professor H. C. Urey, Nobel Laureate in Chemistry, stated his conviction that the only way of dealing with the atomic bomb problem was for a superior world government of some kind to ensure that no atomic bombs are made anywhere in the world, and that no atomic bombs must be in the possession of any government of any kind.

Forthcoming Events

November 13. Hull Chemical and Engineering Society. Regal Room, Regal Avenue, Ferensway, Hull, 7.30 p.m. Mr. W. F. Potter: "Modern Cutting Tools."

November 13. Chadwick Public Lectures. Royal Sanitary Institute, 90 Buckingham Palace Road, London, S.W.1. Mr. F. Vokes: "The Modern System of Sewage Disposal and the Methods and Materials Employed."

November 13. Institution of Chemical Engineers and Chemical Engineering Group. Apartments of the Geological Society, Burlington House, Piccadilly, London, W.1. 5.30 p.m. Mr. Hemingway Jones: "Some Practical Aspects of Large-Scale Gas Distribution, with particular reference to Steelworks."

November 14. Royal Society of Arts. John Adam Street, London, W.C.2. 1.45 p.m. Mr. A. C. Hartley: "Operation PLUTO."

November 14. Society of Chemical Industry (Food Group, Microbiological Panel). Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1. 2.30 p.m. Mr. R. L. Wain: "The Fungicidal Action of Copper."

November 15. Royal Institute of Chemistry (East Anglian Section). Norwich City College, Norwich, 7.30 p.m. Mr. Donald Matheson: "Protection from Poisons in Industry."

November 15. Chemical Society (Liverpool Section). Muspratt Lecture Theatre, Liverpool University, 4 p.m. Mr. R. P. Bell: "The Structure of the Boron Hydrides and Related Compounds."

November 15. Royal Institute of Chemistry (Manchester and District Section). Engineer's Club, Albert Square, 7 p.m. Mr. R. B. Pilcher: "Chemists, 1892-1944."

November 16. Chemical Society (Manchester Section). Chemistry Lecture Theatre, Manchester University, 6 p.m. Presentation of Original Papers.

November 16. Chemical Society (Glasgow Section). Royal Technical College, Glasgow, 7.15 p.m. Professor J. M. Gulland: "Polynucleotides and Nucleoproteins."

November 16. Royal Institute of Chemistry. Rooms of the Geological Society, Burlington House, Piccadilly, London, W.1. 6 p.m. Mr. W. Gordon Carey: "Water and Public Health." (Streatfeild Memorial Lecture.)

November 16. Chemical Society (Sheffield Section) and Sheffield University Chemical Society. Chemistry Lecture Theatre, Sheffield University, Sheffield, 5.30 p.m. Professor I. M. Heilbron: "Our War Against Insect Pests."

November 16. Society of Chemical Industry (Birmingham and Midlands Section) (Plastics Group), and Royal Institute of Chemistry. The English Theatre, Birmingham University, Edmund Street, Birmingham, 6.30 p.m. Dr. J. C. Swallow: "Polythene."

November 17. Royal Institute of Chemistry (London and S.E. Counties Section). Slater's Oak Restaurant, 18 Kensington High Street, London, W., 6.15 p.m. to 10.15 p.m. Dance.

November 17. The Institution of Chemical Engineers (North - Western Branch). Reynolds Hall, College of Technology, Manchester, 3 p.m. Mr. L. F. Keeley: "Heat-Resisting Steels."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

E. & D. H. RICHARDS, LTD., Oswestry, fertiliser manufacturers. (M.S., 10/11/45.) Satisfaction, October 17, £550, registered January 24, 1936.

WALKER PERFECTION FIRE EXTINGUISHER, LTD., London, N. (M.S., 10/11/45.) Satisfaction, October 19, of assignment registered March 18, 1942.

Company News

Cerebos, Ltd., are maintaining their interim dividend at 10 per cent.

Sandoz A.G., Basle, has increased its capital from 10,000,000 to 15,000,000 francs.

Metal Industries, Ltd., is paying an interim dividend, on its "A" and "B" ordinaries, of 3 per cent. (same).

International Nickel Co. of Canada has declared a quarterly common dividend of 40 cents, making a total of \$1.60 (same).

British Celanese, Ltd., report a net profit, for the year to June 30, of £560,446 (£728,673). A first and final ordinary dividend of 8 per cent. has been declared (15 per cent.). The second preference is reduced to 8.8875 per cent. (10 per cent.).

New Companies Registered

Richard Smith, Ltd. (23,549).—Private company. Registered in Edinburgh. Capital £50,000 in 20,000 preference and 30,000 ordinary shares. Manufacturers, exporters, importers, agents and dealers in acids, alkalis, chemicals, etc. Directors: W. McFarlane, 15 Latham Drive, Glasgow, S.3; E. Boston; F. Tudsbury; F. Ellison; K. Barge; L. Hilton.

Prices of British Chemical Products

A FAIRLY steady demand has been maintained in all sections of the London industrial chemical market during the past week and contract deliveries have covered good volumes. There has been a steady flow of fresh inquiry from overseas markets and a fair amount of new bookings have been taken in the home market. In the soda products section, hyposulphite of soda and chlorate of soda are active items, and a sustained demand is reported for caustic soda and acetate of soda. Supplies of yellow prussiate of soda continue scarce. Among the potash chemicals, British makers of permanganate of potash are well booked and supplies of the pharmaceutical and technical qualities are being promptly disposed of. Inquiries for acid phosphate of potash have been on steady lines. In the acid section, the maximum controlled prices for tartaric acid and cream of tartar have been reduced from November 3. There is little fresh to report from the coal-tar products section. Pitch is in good demand both for home and export trade, while there is a steady call for supplies of creosote oil and carbolic acid.

Naphthalene is a good market and the pyridines are quiet.

MANCHESTER.—Except in one or two directions, the price position on the Manchester chemical market is on a steady to firm basis and it is not expected that there will be much in the way of recessions. The alkalis generally, as well as most of the other leading "heavies," are meeting with a reasonably steady demand from domestic users, and, on the whole, replacement buying is going on satisfactorily. Export business is also displaying a satisfactory trend and a steady movement of supplies of the soda compounds is reported. Among the tar products, a steady demand for creosote oil, motor benzol, carbolic acid, and the naphthalenes remain the outstanding features.

GLASGOW.—In the Scottish heavy chemical trade during the past week, business remained very quiet in the home market owing to the continuation of labour troubles at the various docks, but now that these have been temporarily settled, business should resume its normal activities. Export business also has been quiet, and prices remain firm.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £39 10s.; 10 cwt./1 ton, £40 10s.; 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—Ex works, £11 5s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf.

Fine white 98%, £19 10s. per ton. See also Salammoniac.

Antimony Oxide.—£103 10s. to £109 10s. per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£15 to £16 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 7d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6½d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£32 5s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £52 per ton ex works; barrels returnable.

Lead Acetate.—White, 52s. to 55s. per cwt. according to quantity.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—Basic prices, per ton: Genuine dry red lead, £45 10s.; rutile, £45 10s.; orange lead, £57 10s. Ground in oil: Red, £59; orange, £71. Ready-mixed lead paint: Red, £63 10s.; orange, £75 10s.

Lead, White.—Dry English, in 8-cwt. casks, £55 per ton. Ground in oil, English, in 5-cwt. casks, £67 per ton.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride.—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt. lots, 8s. 5d.; for 7 to 28-lb. lots, 8s. 11d.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 7½d. per lb.; ground, 8½d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £67 5s. per ton ex store; hydrated, £61 10s. per ton.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P. 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 12s. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic.—Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals (4-ton lots or more), per cwt. in kegs 24s. 3d., in bags 17s. 9d.; (ton lots) 25s. in kegs, 18s. 6d. in bags; commercial, 5-ton lots, £16 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£20 to £23 10s. per ton.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £22 per ton d/d for ton lots. Tri-sodium, £25 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, ground, £15-£16.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d: white seal, £38 15s.; green seal, £37 15s.; red seal, £36 5s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

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Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£34 to £39 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 6 3/16d. to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

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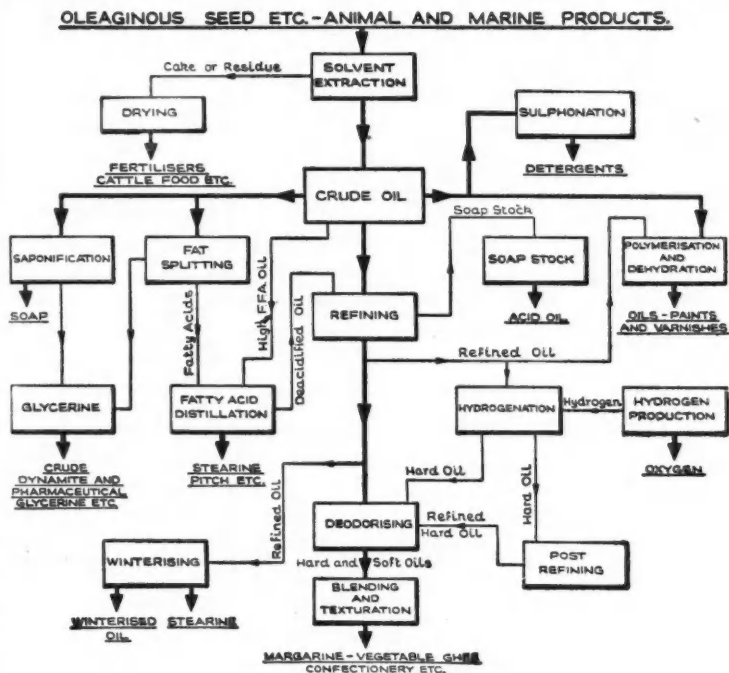
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Chemical and Allied Stocks and Shares

STOCK markets have been active, with profit-taking rather more in evidence in industrial shares, and sentiment generally reflecting a tendency to await international developments. British Funds continued active but, following further gains, long-dated stocks reacted slightly; and medium-dated stocks attracted buyers. The Cable & Wireless and civil aviation developments caused a certain amount of uncertainty among "nationalisation shares."

Shares of chemical and kindred companies remained steady generally, with Imperial Chemical at 41s. 6d. favoured, while Turner & Newall moved higher again at 84s. 6d. Distillers were 118s. 3d., and United Molasses 43s., but British Plaster Board eased to 34s. 9d. Lever & Unilever were favoured and moved slightly higher at 53s. 3d.

British Celanese were a weak feature, these 10s. units falling back from 35s. to 32s. 6d. on the "cut" in the dividend from 15 per cent. to 8 per cent.; while the participating preference declined from 32s. 7½d. to 32s. 3d. Courtaulds at 57s. 9d. were little changed, and other textiles were firmer on the statements of the chairman of the Cotton Board. Bleachers improved to 14s., and Bradford Dyers to 27s. 3d. Paint shares have been fairly active with Lewis Berger good at 117s. 6d. on market talk of a possible increase in dividend and of benefits from the reduction in E.P.T. Elsewhere, Triplex Glass 10s. units moved higher to 41s., and Dunlop Rubber were 55s. 3d., while Barry & Staines strengthened to 55s. 1½d., Nairn & Greenwich to 80s. 7½d., and Wall Paper Manufacturers deferred were better at 43s.

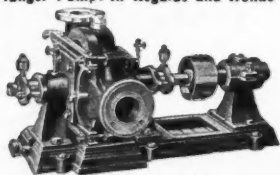
Iron and steels were little changed, United Steel being 24s. 10½d., Staveley 50s., Ruston & Hornsby 57s. 3d., and Dorman Long 26s. 10½d. Tube Investments were higher at £5 13/16 on the company's peace-time prospects. Allied Ironfounders were in demand up to 58s. on the removal of purchase tax on some of the company's products, and Cannon Iron at 18s. 9d. were better for a similar reason. Elsewhere, Babcock & Wilcox have been firm at 60s., but Davy Engineering at 35s. 6d. lost part of an earlier improvement. General Electric were 98s. 3d., Associated Electrical 59s. 6d., and Brush Electrical 5s. shares 10s. 6d. Metal Box shares at 98s. 9d. lost part of their recent advance, and Amalgamated Metal went back to 19s. 1½d. Radiation ordinary held their rise to 61s. 3d.

British Drug Houses kept at 47s. but were less active. W. J. Bush were around 78s. 9d., Burt Boulton 27s., Cellon 5s. shares 26s. 9d., Lawes Chemical 10s. shares 12s., and British Glues & Chemicals 4s. shares

12s. 9d. B. Laporte remained at 87s. United Glass Bottle were 72s. 6d., and Canning Town Glass 5s. ordinary active up to 10s. 3d., the latter on estimates as to benefits from the reduction of E.P.T. British Tar Products 5s. shares were 12s. 6d., and British Lead Mills 2s. ordinary 5s. 6d. Boots Drug at 56s. 6d. and Timothy Whites at 43s. 6d. were little changed. Sangers were 31s. 7½d., while Beechams deferred moved up to 22s. 4½d. on estimated benefits arising from lower E.P.T. Associated Cement were 58s. 3d., and Gas Light & Coke ordinary 23s. 3d.

Oils have been uncertain, Anglo-Iranian receding to £5½, and Shell to 80s. 7½d., but Lobitos at 56s. 6d. were steady on the full results, and later the tendency was generally firmer.

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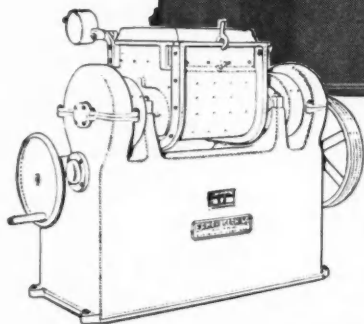
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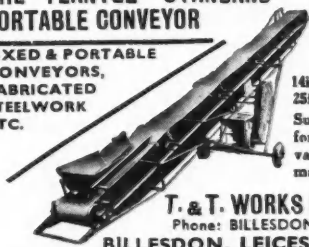
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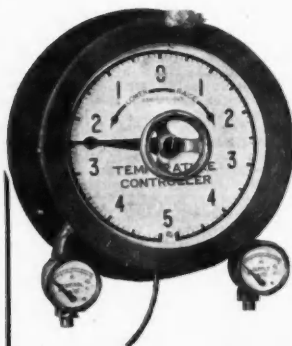
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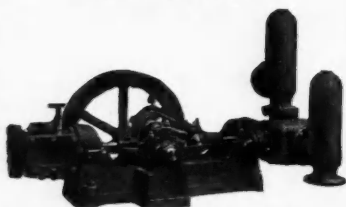
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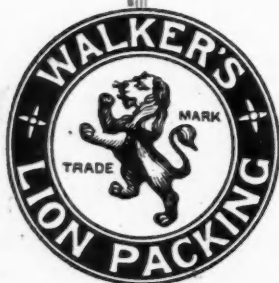
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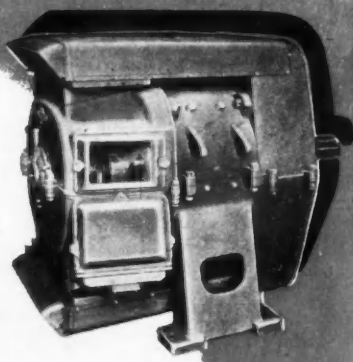
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